



MEMORANDUM

TO: Hillary Ward, U.S. Environmental Protection Agency, OAQPS/Sector Policies and Programs Division, Fuels and Incineration Group

FROM: Eastern Research Group, Inc. (ERG)

DATE: July 2015

SUBJECT: Summary of Updated Landfill Dataset Used in the Cost and Emission Impacts Analysis of Landfill Regulations

Introduction

The EPA is reviewing the new source performance standards (NSPS) and emission guidelines (EG) for municipal solid waste (MSW) landfills (40 CFR part 60, subpart WWW and 40 CFR part 60, subpart Cc, respectively). Currently, the regulations require landfills that are at least 2.5 million megagrams (Mg) and 2.5 million cubic meters in size and that have estimated nonmethane organic compounds (NMOC) emissions of at least 50 Mg per year to collect and control or treat landfill gas (LFG).¹

As a first step in developing the estimated cost and emission impacts of various changes to the current regulatory requirements resulting from the ongoing review of the NSPS/EG, a dataset of existing (current) and future (projected) landfills was created (NSPS/EG dataset) in July 2014. The purpose of this memorandum is to document changes made to the July 2014 dataset to reflect more recent and comprehensive data.

Using the updated NSPS/EG dataset as an input, a Microsoft® Access database was developed to calculate the emission reductions and costs. The assumptions and calculations used in the database are detailed in the 2015 memorandum, *Updated Methodology for Estimating Cost and Emission Impacts of MSW Landfill Regulations*.

1. Landfill Data Sources

The landfill databases^{2,3} used in the July 2014 NSPS proposal and ANPRM were updated using data from the Greenhouse Gas Reporting Program (GHGRP), select web searches, and input from EPA Regions and state and local regulatory agencies on landfills expected to undergo a modification in the next 5 years. Landfills that stopped accepting waste on or before November 8, 1987 are not affected by the EG. To accommodate this rule applicability criterion for the purposes of the dataset, any landfill closing before 1988 was removed from the consolidated dataset. After each data source was reviewed, data from the various sources were combined appropriately. The entire dataset was then reviewed to remove duplicate

¹ The requirements for existing sources under the state and federal plans implementing the EG are similar to those for new sources under the current NSPS.

² ERG. 2014. Modeling Database Containing Inputs and Results of Proposed Revisions to MSW Landfill NSPS.

³ ERG. 2014. Modeling Database Containing Inputs and Preliminary Impacts for Review of the MSW Landfill Emission Guidelines.

landfills across reporting years or between the various data sources. The sources for data updates are described below.

1.1 GHGRP Data

GHGRP reporting year (RY) 2013 data are the primary data source for this updated dataset. Where landfills did not have data for RY2013, data from RY2012 were used. When both RY2012-RY2013 were missing, RY2011 data were used. RY2010 data were used only if no other reporting data were available. The data tables in Appendix B of this memorandum show which reporting year basis was used for various key data parameters. Information about the landfill itself, current and historical annual waste acceptance rates, as well as gas collection and control system (GCCS) data (as applicable) were incorporated into the database. These annual historical waste rate data serve as a significant improvement to the data input file used to generate emission estimates. 1,217 of 1,970 landfills in the dataset were from GHGRP Subpart HH data.

1.2 Website Research for Select LMOP Landfills

Several landfills in the July 2014 dataset did not report to GHGRP but had data available from EPA's Landfill Methane Outreach Program (LMOP) to model emissions. These GHGRP non-reporters were reviewed further if the landfill had design capacities above 2 million Mg and had a calculated emission rate above 30 Mg/yr NMOC, which is approximately equivalent to the reporting threshold of 25,000 mtCO₂e threshold uses in GHGRP. After researching these landfills online, the data inputs at four LMOP landfills were adjusted and updated in the new dataset. The other LMOP landfills (744 of the 1,970 landfills) remained unchanged from the July 2014 dataset.

1.3 Modification Analysis

In fall 2014, EPA contacted EPA Regions and state agencies to request information about modifications to existing landfills that were pending or occurred over the past 5 years. This voluntary outreach was conducted to identify landfills expected to increase their permitted design capacity after the July 2014 proposal, rendering them applicable to standards for new landfills. EPA requested data on the characteristics of landfills undergoing a modification, such as timing of expansion and permit approval, amount of waste capacity being added, and identification of landfills known to be expanding. In addition, EPA performed online searches for permit modification information for states expected to have landfills being modified where state regulatory authorities have shared this type of information.

As a result of these combined outreach efforts, 25 landfills were flagged in the NSPS/EG dataset as landfills anticipated to modify their design capacity in the next 5 years (2014-2018), and 18 of these 25 landfills were updated to include expansion data such as updated design capacity, updated estimated closure year, updated acreage, anticipated year of modification, or updated annual waste acceptance rates. Appendix A-1 summarizes the modification data collected for each EPA Region, by state/district/territory. If technical data parameters were updated as part of the modification, these landfills are denoted with a flag field of "Actual" in the ModFlag data field. If no technical data were updated, the landfill is denoted with a flag field of "Actual Flag only" in the ModFlag data field.

For states where modification information was unavailable, EPA estimated the landfills expected to modify based on significant changes in design capacity values. For this analysis, significant change threshold was identified based on at least a 5 percent increase in capacity when comparing GHGRP Subpart HH RY2013 data to each of the three prior years (RY2010-RY2012). A total of 108 landfills were flagged as anticipated to modify their design capacity in the next 5 years using Subpart HH data, and these landfills are shown in Appendix A-2. While these landfills likely modified prior to the July 17, 2014 applicability date of Subpart XXX, the number and characteristics of these mods were used to approximate the number and types of

landfills undergoing modifications in the near future. These landfills are denoted as “Surrogate” in the ModFlag data field.

Collectively, from actual and surrogate modification information, a total of 133 landfills were identified as ones expected to modify their design capacity between 2014 and 2018. Cost and emissions impacts for these 133 landfills will be transferred from the EG to the NSPS in the year the modification is anticipated to commence construction. It is important to note that landfills with a post-expansion permitted design capacity below 2.0 million Mg were excluded from the modification analysis because size thresholds below 2.0 million Mg were not considered in the impacts analysis for the proposed Emission Guidelines.

While conducting the research for landfills expected to modify in the near future, five new landfills were identified and added to the dataset. Some of these landfills opened or significantly modified recently or were permitted but not yet constructed. As such, open years were estimated for the purpose of generating LFG emission curves. These landfills are shown in Appendix A-3.

2. Filling Data Gaps

For LMOP landfills, the basis of the fields in the dataset and gap filling did not change since the July 2014 dataset except when corrections were made from more recent web research as noted above.⁴ For GHGRP landfills, there were significant updates made to the dataset and sometimes reported and calculated parameters did not agree with one another, or there were multiple methods for filling a data gap. This section documents how the parameters were finalized for the dataset.

2.1 Design Capacity

Design capacity is reported to GHGRP HH Landfills Info data table. Generally the reported value was used in the regulatory database unless one of the two conditions below were met:

1. The calculated waste-in-place (WIP) in 2013 (based on the sum of all annual waste acceptance rates) exceeded the reported design capacity. This happened for 63 landfills.
2. The calculated future annual waste acceptance rates (AWAR) were +/- 10% different than the most recently reported AWAR when using the following equation:

$$AWAR = (Design\ Capacity - 2013\ WIP) / (Estimated\ landfill\ closure\ year - 2013)$$

If either of these two criteria were met, the calculated WIP based on the reported estimated closure year of the landfill (if before year 2078) or the calculated WIP in year 2078 (the maximum year included in the regulatory analysis) was entered in lieu of the design capacity.

As a final step, the capacity was converted from metric tons to short tons to be consistent with how the other design capacities were stored in the database.

2.2 Current Area

The Landfill surface area containing waste is reported in the GHGRP HH Landfills Info data table and is stored in the field *Landfill Surface Area* in the GHGRP Landfill Inventory table of the regulatory database.

If the area of the landfill with a GCCS (see Section 2.3) exceeded the area with waste, the current area was set equal to the GCCS area. If there were reported areas less than 40,000 m² or greater than 9,000,000 m²,

⁴ ERG 2014. Summary of Landfill Dataset Used in the Cost and Emission Impacts Analysis of Landfill Regulations.

these areas were deemed outliers based on the area distributions of the remainder of the dataset and compared to LMOP acreage data. Five landfills were identified as outliers and reviewed against reported acreages in the LMOP database and in each of the five cases the acreage in GHGRP was replaced with the reported current acreage data in the LMOP database.

As a final step, the area was converted from m² to acres to be compatible with the costing equations.

2.3 GCCS Area

The acreage of a landfill with a GCCS installed was computed using surface area data reported in the GHGRP HH_LNDFIL_WTH_GAS_CLCT_WST_DEP data table. The areas are reported with different surface type codes, with codes A2-A5 representing areas with a GCCS installed. The sum of these area types represents the total area with a GCCS installed. See the data field *SumOfSurfaceArea-GCCSArea* in the GHGRP Landfill Inventory table of the regulatory database.

If there were reported areas <40,000 m² (but not zero, which would represent no GCCS is installed) or >9,000,000 m², these areas were deemed outliers based on the area distributions of the remainder of the dataset. The data were reviewed and the reported well count in the GHGRP HH_GAS_COLLECTION_SYSTEM_DETLS data table were used to estimate the GCCS area, assuming a well density of 1 well per acre.

There were also three landfills that had a calculated GCCS area greater than zero but had a GCCS indicator flag indicating no system was installed. These three landfills were reviewed against LMOP data and one of the three landfills (Landfill ID# 528332) had its GCCS area changed to zero since the LMOP database indicated this project shutdown due to lack of gas.

As a final step, the area was converted from m² to acres to be compatible with the costing equations.

2.4 Design Area

The total design area of a landfill was computed by summing the various types of surface areas reported for landfills in the GHGRP HH_LNDFIL_WTH_GAS_CLCT_WST_DEP. The area types A1, A2, A3, A4, and A5 were summed to compute a design area in square meters. See the data field *SumOfSurfaceArea-TotalDesignedArea* in the Background Data: GHGRP Landfill Inventory table.

If the current area described in Section 2.2 exceeded the calculated design area, the design area was set equal to the current area. If the current area was equal to the design area and the landfill was still open, the design area was flagged as suspect and was recalculated using the equation below. Similarly, if there were calculated areas less than 40,000 m² or greater than 9,000,000 m², these areas were deemed outliers based on the area distributions of the remainder of the dataset and the design area was recalculated using the equations below.

1. If ratio of 2013 WIP/Design Capacity ≤ 1 ; Design area = current area⁵/(WIP/DC).
2. If the above calculation was in the suspected outlier threshold range of less than 40,000 m² or greater than 9,000,000 m², the calculated value was compared to the reported design capacity in the LMOP database, if available.
3. If the ratio of 2013 WIP/Design Capacity is > 1 , the reported design and current acreages in the LMOP database were compared to the calculated design area.

⁵ Current area, as corrected according to Section 2.2.

As a final step, the area was converted from m² to acres to be compatible with the costing equations.

2.5 Depth

Waste depth data were reported in the GHGRP HH_LNDFIL_WTH_GAS_CLCT_WST_DEP data table for landfills with a GCCS installed. The average and maximum depths reported for each landfill in surface area types A2, A3, A4, and A5 were computed. Areas with zero depth were excluded from the averaging. These calculated data fields are stored in MaxOfWaste Depth and AvgOfWaste Depth in the Background Data: GHGRP Landfill Inventory table.

The calculated maximum depth of waste was used in the cost analysis to be conservative.

For landfills without a GCCS, the designed depth of the landfill was calculated using the following equation and an assumed waste density of 45 cubic feet per short ton.

$$\text{Depth (meters)} = \text{Design Capacity (Mg)} \times 45 \frac{\text{ft}^3}{\text{ton}} \div 35.315 \frac{\text{ft}^3}{\text{m}^3} \times 1.1 \frac{\text{ton}}{\text{Mg}} \div \text{Design Area (m}^2\text{)}$$

If there were reported or calculated depths less than 5 meters or greater than 300 meters, these depths were deemed outliers based on the waste depth distributions of the remainder of the dataset. The data were reviewed against the depths in the 2014 dataset and four of the values were changed to be consistent with the reported depths in the proposal dataset.

As a final step, the depth was converted from feet to meters to be compatible with the costing equations.

3. Model Landfills

In the July 2014 dataset, model landfills were based on the number and characteristics of landfills opening between 2003 and 2010 to project new landfills. The data sources for the landfill inventory were considered complete through year 2010. Since the majority of revised data were based on GHGRP RY2013, the data were now considered complete through year 2012. As a result, landfills opening between 2005 and 2012 in the GHGRP and LMOP databases were used to project new greenfield landfills opening between 2013 and 2018.

Similar to the methods used in the July 2014 dataset, it was assumed that the sizes and locations of landfills opening in the most recent complete 8 years of data (2005-2012) would be similar to landfills opening in the future (2013-2018). Based on this analysis, five model landfills were created to represent landfills opening in year 2013 and were assigned to the Emission Guidelines database with a prefix identifier of “EG” (example: landfill ID EG1). All five of the EG greenfield model landfills has a design capacity of at least 2.5 million Mg.

Eleven model landfills were created to represent landfills opening in 2014-2018 and these models were assigned to the NSPS database with a prefix identifier of “NSPS” (example: landfill ID NSPS1). Of the 11 model landfills, ten had a design capacity of at least 2.5 million Mg.

4. Final Dataset

Considering models and actual landfills from the GHGRP, LMOP, and other data sources, there are 1,986 landfills in the dataset. Of these, 147 landfills are in the EG database and 1,839 are in the NSPS database.

Appendix B provides a detailed listing of the background data sources, data tables, field names, and field descriptions (including units of measure) for the EG database. Appendix C provides a similar listing for the data tables in the NSPS database. The contents of each dataset are available in a database format.^{6,7}

⁶ ERG. 2015. Modeling Database Containing Inputs and Results of Supplemental Proposal for MSW Landfill NSPS.

⁷ ERG. 2015. Modeling Database Containing Inputs and Results for Review of the MSW Landfill Emission Guidelines.